Taking The Science Measurement To A Higher Level

PARTEQ Innovations, Queen's University

By designing analytical equipment that's easy to use, inexpensive and more precise, Qubit Systems is changing the way universities teach and conduct research.

Founded in 1995 as a spin-off company from Queen's University in Kingston, Ontario, Qubit Systems Inc. is indeed a technology transfer success story. The Canadian company designs and manufactures state-of-the-art analytical instruments for teaching and research in the biological sciences. Today Qubit Systems provides standard and customized research and instrumentation systems for more than 500 educational and research institutes around the world.

Professors David Layzell, Stephen Hunt and Nicholas Dowling of Queen's University recognized the need for durable, inexpensive laboratory equipment for their students.

"When using research equipment in teaching labs, the costs and availability of such equipment often means that students merely gather around expensive pieces of research equipment for demos of physiological processes," says Hunt, president and CEO of Qubit. "We wanted to change all that. Since Qubit equipment is sometimes only one-tenth the cost of typical research equipment, labs can purchase several Qubit packages for the price of one research instrument. This allows small groups of students to do hands-on experiments themselves, which is really the only way

to teach, instead of just gaping at a black box spitting numbers."

Several of Qubit's products are the first of their kind, such as a patented differential oxygen analyzer that allows researchers to conduct experiments in plant and insect metabolic analysis that were previously impossible.

"Nobody else was able to make an O2 analyzer with the required resolution," says Hunt. "We have also come up with innovative ways to measure nitrogen fixation from legumes, which is greatly expanding our knowledge of this very important process."

These new methods have shown that previous studies greatly underestimated N2 fixation rates. Research based on improved techniques will hopefully lead toward new farming methods that result in healthier plants and higher yields.

PARTEQ Innovations is the not-for-profit technology transfer office of Queen's University and has supported Qubit from its inception. In the early days the company worked out of an incubator facility that was jointly funded by Queen's University and the City of Kingston. PARTEQ also financed Qubit's initial work with a loan of $24,000 and helped secure a larger $150,000 loan through the Business Development Bank of Canada. Additionally, PARTEQ assisted Qubit with its business plan and intellectual property protection. To date, Qubit has six patents in the U.S., Canada, Europe and Australia.

Easier for Students

Qubit's technology and innovative designs have resulted in simplified, inexpensive, highly accurate instruments that work well for both research and teaching. The analyzers are integrated into complete software-controlled systems for measuring processes such as photosynthesis and respiration in living organisms.

"The simplicity of Qubit's designs allows students to understand the processes they are measuring better than our more elegant, expensive, portable photosynthesis machine does," indicates Professor Judy Parrish, Ph.D., of Milliken University in Decatur, Ill.

Because they are developed by university professors with actual teaching experience, Qubit's educational packages are designed to fit perfectly into curriculum lab work. Several packages are one-of-a-kind products that make it possible to explore subjects such as fish respirometry, nitrogen fixation, and soil respiration — all of which are key indicators of the health of our waters and soils.

"Another excellent feature is that the students can assemble the unit, get it working, and then handle the data," adds Warwick Silvester, Ph.D., of the University of Waikato in Hamilton, New Zealand. "This is great from a teaching point of view in that students feel they are in control and they learn the real pitfalls in setup and data handling."

> *Because Qubit's gear is low-cost, universities can afford to furnish entire laboratories with multiple Qubit teaching packages, an attractive option for higher-education institutions in poorer nations.*

"In addition to their teaching value, many of our educational packages have the resolution and accuracy suitable for research applications, allowing scientists in developing countries with low R&D budgets to carry out top-level research at a very affordable price," comments Hunt.

The high resolution and durability of Qubit equipment makes it ideal for use in both the laboratory and in a wide variety of field situations. Researchers on an icebreaker in the Canadian arctic, and others in the tropical rainforests of

Costa Rica, use Qubit equipment to monitor respiration in samples as diverse as crustaceans and the eggs of sea turtles. In fact, an increasing number of articles in notable research journals are based on research conducted with Qubit instrumentation.

Qubit is also tackling problems associated with global warming by providing analyzers to measure fluctuations in greenhouse gases in a variety of environments. In addition, Qubit equipment is being used in a unique study to determine if the accumulation of greenhouse gases may have resulted in past global catastrophes. Scientists at the University of Washington are using Qubit technology to recreate the atmosphere from the Permian period — the last period of the Paleozoic Era — to study how an ancient period of global warming may have resulted in an extinction of plant and animal species.

In the Near Future

Qubit Systems now derives more than 60 percent of its revenues from products designed for scientific research. Recent partnerships with companies in the United Kingdom, Denmark and the Czech Republic have led to exciting new projects in pharmaceutical development, fish biology and plant science. Qubit also builds customized instruments for private-sector companies, such as a system for the food industry that determines the freshness of salads prior to packaging, and equipment for the pharmaceutical industry that creates the low-oxygen environment required for keeping extremely expensive chemicals (reagents) from breaking down during storage.

The company is also hard at work developing new products in the field of human exercise physiology. These devices, which can be used in private practice, research and teaching, will analyze breath gases to better evaluate cardiovascular health and fitness. Medical students will be able to determine their own metabolic rates through breath analysis, which provides much more accurate assessment of fitness than other methods.

“Many breath-analysis systems available now cost $40,000-$50,000, and only large health care centers can afford them,” says Hunt. “Ours will be half that cost, making it much easier for individual physicians to afford them. This means patients won’t have to be sent to hospitals for testing, which should help lower overall health care costs. Other products derived from our fitness-testing equipment will be ideal for personal fitness assessment in health clubs, and for use by individuals who must monitor their diets and metabolism very closely, such as people who are obese or have cardiovascular problems.”

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